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Federal Information Architecture Initiatives

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Abstract

This document summarizes government and industry technical and information standards and illustrates how some federal agencies have adapted these standards in planning for and building their technical and information architectures.

KEYWORDS: enterprise architecture, information architecture, standards, planning, technical architecture, information technology architecture, data integration, interoperability, data management

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Section 1

Background

In developing its architectural plans, the FAA will be dealing with many of the same issues that other Federal agencies are addressing. The FAA will consider both the basis and the specific direction that other agencies have taken in formulating its own approach to structural information architecture issues (as opposed to specific information architecture issues that are FAA-unique).

The basis for Federal information architecture policy stems from a number of sources, including Presidential Executive Order, the Office of Management and Budget (OMB), the National Institute for Standards and Technology (NIST), and the Congress. A summary of the guidelines and policies from these government bodies is presented below.

Presidential Order. In Section 1. Policy of Executive Order 13011 dated July 16, 1996, the President ordered that executive agencies shall:

a) ***"significantly improve the management of their information systems, including the acquisition of information technology…;***

b) ***refocus information technology management to support directly their strategic missions, implement an investment review process that drives budget formulation and execution for information systems, and rethink and restructure the way they perform their functions before investing in information technology to support that work;***

c) ***establish clear accountability for information resources management activities by creating agency Chief Information Officers (CIOs) with the visibility and management responsibilities necessary to advise the agency head on the design, development, and implementation of those information systems…;***

d) ***cooperate in the use of information technology to improve the productivity of Federal programs and to promote a coordinated, interoperable, secure, and shared Government-wide infrastructure…; and***

e) ***establish an interagency support structure that builds on existing successful interagency efforts and shall provide expertise and advice to agencies; expand the skill and career development opportunities of information technology professionals; improve the management and use of information technology within and among agencies by developing information technology procedures and standards and by identifying and sharing experiences, ideas, and promising practices; and provide innovative, multidisciplinary, project-specific support to***

agencies to enhance interoperability, minimize unnecessary duplication of effort, and capitalize on agency successes."

Executive Order 13011 was supplemented by Memorandum M-97-16 issued June 18, 1997, from the Executive Office of the President, Office of Management and Budget, and mandates Federal agencies to develop and implement Information Technology Architectures (ITA) as follows.

- ***"This memorandum transmits guidance to Federal agencies on the development and implementation of Information Technology Architectures. The Information Technology Architecture (ITA) describes the relationships among the work the agency does, the information the agency uses, and the information technology that the agency needs. It includes standards that guide the design of new systems. An ITA makes it easier to share information internally (e.g., agency-wide e-mail) and to reduce the number of information systems that perform similar functions. The ITA provides the technology vision to guide resource decisions that reduce costs and improve mission performance.***
- ***OMB Memorandum 97-02, "Funding Information Systems Investments," (October 25, 1996), requires that agency investments in major information systems should be consistent with Federal, agency, and bureau ITAs. The Clinger-Cohen Act of 1996 (Public Law 104-106) assigns the Chief Information Officer the responsibility of developing, maintaining, and facilitating the implementation of the information technology architecture.***
- ***As described in the attachment, a complete ITA is the documentation of the relationships among business and management processes and information technology that ensures:***
  - ***Alignment of the requirements for agency-sponsored information systems (as defined in OMB Circular A-130) with the processes that support the agency's missions and goals;***
  - ***Adequate interoperability, redundancy, and security of information systems;***
  - ***The application and maintenance of a collection of standards by which the agency evaluates and acquires new systems.***

Federal Information Architecture Initiatives. The purpose of this section is to document successful Federal agency efforts to implement these Federal information architecture mandates to capitalize on those agency successes, and to apply lessons learned to improving FAA and NAS information management. This summary should be reviewed and updated as more agency efforts are realized and reported. In addition, agency doctrine documented here will change over time as technology emerges and evolves and as standards mature, thus requiring revisions to the ideas presented here.

Section 2

The National Institute of Standards and Technology (NIST)

NIST is responsible for developing technical, management, physical and administrative standards and guidelines; providing technical assistance; and conducting research for computer systems technology within the Federal government. Two NIST efforts in particular have provided direction to Federal agencies in the development of an open systems environment (OSE) to promote interoperability, portability, scalability, and standardization of agency information architectures and systems. These efforts are:

- ***Information Management Directions: The Integration Challenge*, NIST Special Publication 500-167, September 1989.**
- ***Application Portability Profile (APP) - The U.S. Government's Open System Environment Profile Version 3.0*, NIST Special Publication 500-230, February 1996.**

The NIST report entitled *Information Management Directions: The Integration Challenge* defines the Enterprise Architecture, levels within the Architecture, and the standards required to implement and enforce such an Architecture (Figure 2-1). The NIST Enterprise Architecture has provided a framework for service and agency architecture model definitions. It consists of a five-tiered framework to illustrate business, information, and technology inter-connectivity. Although the tiers are separately identified, they are interrelated. An integrated set of information and information technology architectures can be derived from the Enterprise Architecture. The Department of Energy (DOE) has adopted NIST's Enterprise Architecture model to define its Information Architecture.

The *Application Portability Profile (APP) - The U.S. Government's Open System Environment Profile Version 3.0* provides recommendations on a set of industry, Federal, national, international and other specifications that define interfaces, services, protocols, and data formats to support an OSE. The APP addresses the lowest architecture in the NIST Enterprise Architecture Model, i.e., the Delivery System Architecture. Based on these specification recommendations, various services and agencies have defined detailed technical reference models. Both the U.S. Patent and Trademark Office (PTO) of the Department of Commerce (DoC) and the Department of Defense (DoD) in its Technical Architecture Framework for Information Management (TAFIM) have defined their Technical Reference Models based on NIST's

APP. Table 2-1 presents a subset of the NIST APP Specifications in the areas of Data Management and Data Interchange.

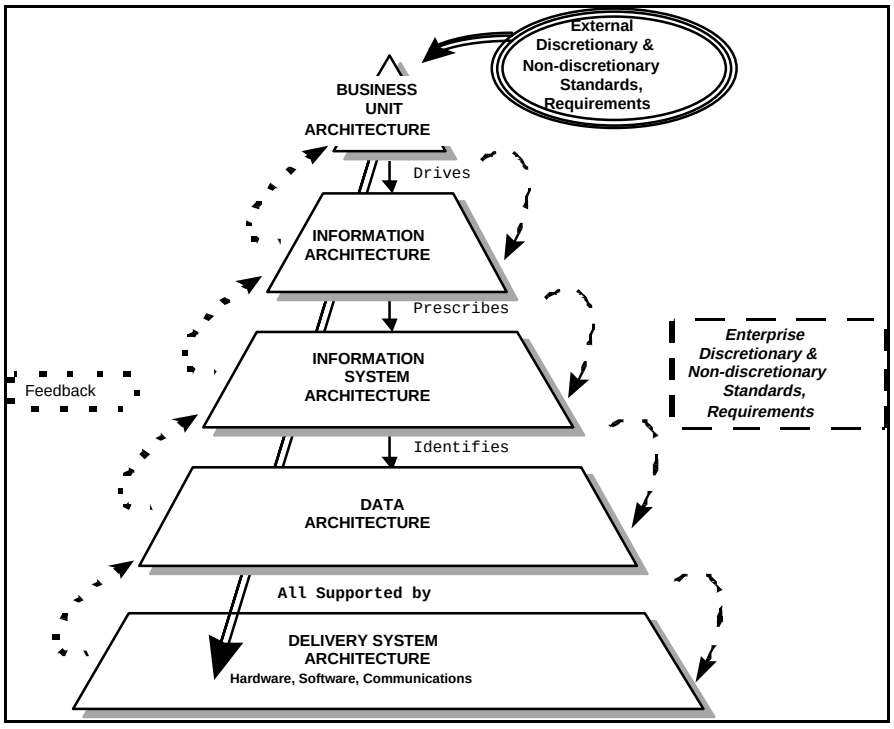

Figure 2-1. NIST's Enterprise Architecture Model

Table 2-1. NIST APP Specifications Summary for Data Management and Data Interchange

OSE Service Area	Core Service	Application Specification
Data Management	**Relational Database Management System**	**FIPS 127-2 SQL**
	Data Dictionary/Directory System	**ISO/IEC 10027:1990 IRDS** [1]
	Distributed Data Access	**ISO/IEC 9579-1:1993 RDA** [2]
	Database Environment	**FIPS 193 SQL Environments**
Data Interchange	**Document Distribution Format**	**PDDF**
	Manuscript Markup Tag Set	**EMPM ANSI/NISO Z39.59**
	Data Element Specification	**Std. Data Elements ISO 11179, Parts 3, 4, and 5**
	Graphics Data Interchange	**FIPS 128-1 CGM**
	Raster Image Interchange	**FIPS 194 Raster**
	Image Compression	**JPEG**
	Video Compression	**MPEG**
	Graphical Product Data Interchange	**FIPS 177 IGES**
	Product Life-cycle Data Interchange	**Planned FIPS on STEP (ISO 10303)**
	Electronic Data Interchange	**FIPS 161-1 EDI**
	Spatial Data Interchange	**FIPS 173-1 SDTS**

1 Note that DOE has adopted the ISO IRDS standard rather than FIPS 156.

2 Note that DOE has adopted the ISO RDA standard rather than FIPS RDA.

Section 3

Enterprise Architecture Planning (EAP)

There are many professional practitioners in the field of system architecture. One of these is Dr. Steven H. Spewak, who has become a respected advisor, practitioner and author.[3] He has written a book about Enterprise Architecture Planning (EAP), which he defines as *"the process of defining architectures for the use of information in support of the business and the plan for implementing those architectures."* Spewak's approach to EAP is similar to that taken by DOE in that the business mission is the primary driver. That is followed by the data required to satisfy the mission, followed by the applications that are built using that data, and finally by the technology to implement the applications. This hierarchy of activity is represented in Figure 3-1. below, in which the layers are implemented in order, from top to bottom.

Based on the Business Systems Planning (BSP) approach developed by John Zachman, EAP takes a data-centric approach to architecture planning to provide data quality, access to data, adaptability to changing requirements, data interoperability and sharing, and cost containment. This view counters the more traditional view that applications should be defined before data needs are determined or provided for.

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3 Enterprise Architecture Planning: Developing a Blueprint for Data, Applications, and Technology, Steven H. Spewak with Steven C. Hill, John Wiley & Sons, New York City, 1995.

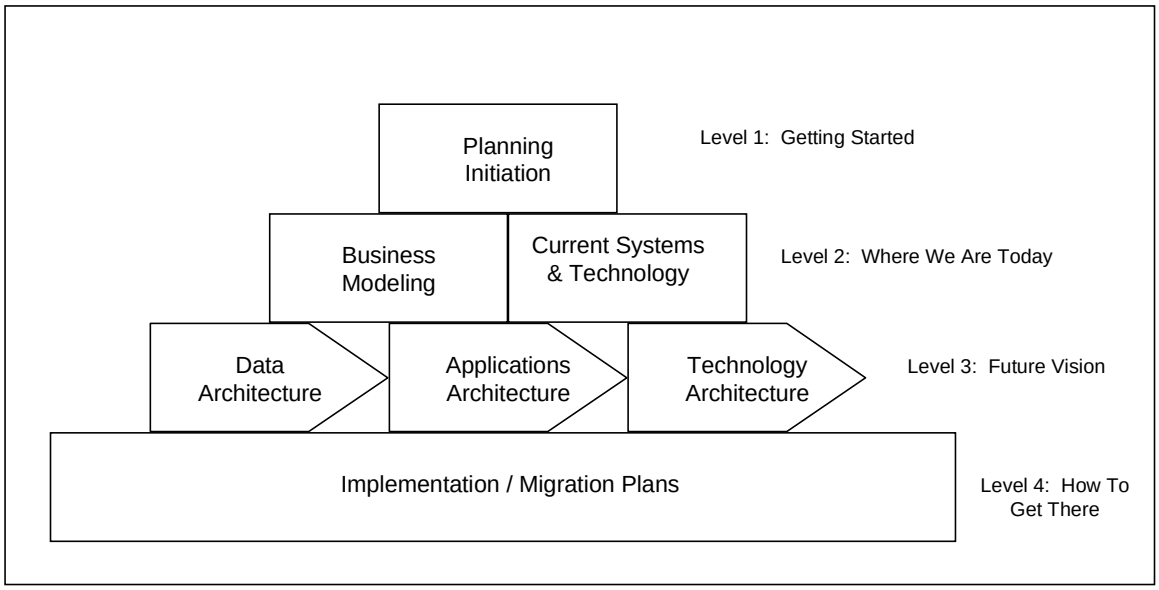

Figure 3-1. Levels of Enterprise Architecture Planning

Section 4

Department of Defense Information Architecture

Because its work is more well known, extensive, and has been published in various media, including on paper and on the internet, the information architecture work of the Department of Defense (DoD) is only referenced in this supplement. The DoD has been a leader in government efforts to systematize the management of its enterprise information within an overall systems architecture framework. Its Technical Architecture for Information Management (TAFIM) is a detailed body of work that describes a system architecture structure based on principles developed by the National Institute of Standards and Technology (NIST). DoD's goals in doing so are similar to those of any organization addressing issues of system reliability, accuracy, flexibility, expandability, and interoperability through a systematic approach to architecture development and system transition. It's purpose is to "provide guidance for the evolution of the DoD technical infrastructure."[4]

More recently, based on its experience in the Gulf War in 1990, in which the various military services found it difficult to share battlefield and support information, the Office of the Assistant Secretary of Defense (ASD) proposed a Joint Technical Architecture (JTA)[5] whose objectives are to:

- **"Provide the foundation for interoperability among all tactical, strategic, and sustaining base systems.**
- **Mandate the standards and guidelines for system development and acquisition which will significantly reduce cost, development time, and fielding time for improved systems, while minimizing the impact on program performance wherever possible.**
- **Influence the direction of industry's standards-based product development so that today's emerging technologies can be more readily leveraged by tomorrow's military systems.**
- **Communicate to industry, DoD's intent to use open systems products and implementations. DoD will buy commercial products and systems, which use open standards, to obtain the best value for limited procurement dollars."**

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4 Defense Information Systems Agency (DISA) Center for Architecture, 1996; multiple volumes.

5 Department of Defense (DOD) Joint Technical Architecture (JTA), 31 October 1997. Detailed information about the JTA may be found at the following website: http://www-jta.itsi.disa.mil/jta

TAFIM and the JTA span the systems architecture process. To more directly address data standards and data architecture, the DoD has been developing its Shared Data Architecture (SHADE) process. As stated in its description, *"SHADE is a strategy and mechanism for data sharing."* It includes the process of data design as well as the definition of DoD data standards to be used in system development. Detailed information about SHADE is available at its website.[6]

6 Please refer to http://diides.ncr.disa.mil/shade/ for additional information about SHADE.

Section 5

Department of Energy (DoE) Information Architecture

DOE defines an information architecture as:

> ***"A conceptual framework that links the Departmental and Programmatic missions, goals, and objectives, and provides a mapping of the current and future DOE business information required to support them."*** [7]

The DoE has adopted the NIST Enterprise Architecture Model to define the DoE Information Architecture (Figure 5-1).[8] The DoE Information Architecture provides a model to inter-connect current "stovepipe" information architectures and implement application systems, data management, and information technology infrastructures throughout DoE.

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7 All information presented in this section was obtained from the DOE home page (http://www.hr.doegob/iat/)

8 Contributions to this effort were made by NIST, the Defense Information Systems Agency, US Air Force Headquarters Dept., and the General Services Administration.

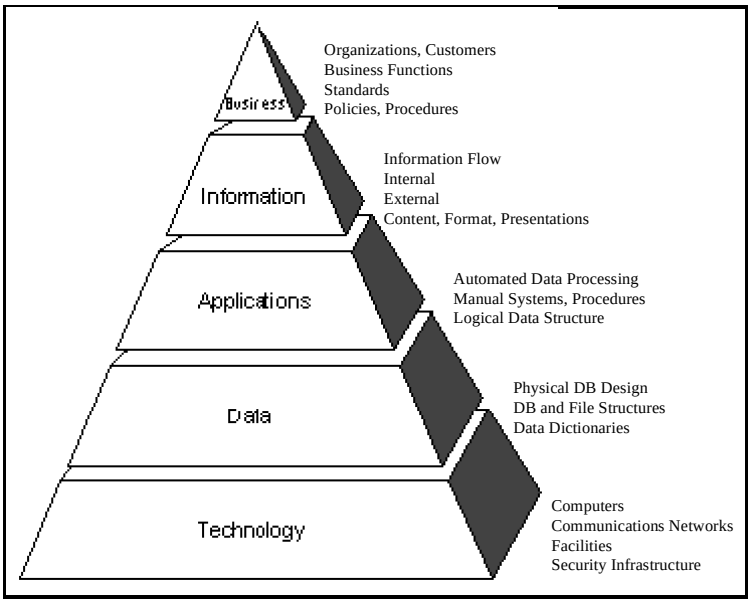

Figure 5-1. DoE Information Architecture View

As shown in the figure, the DoE Information Architecture sub-architectures are defined as follows:

- ***"Business Sub-architecture*—The Business Sub-architecture is a comprehensive documentation of the organization structure, mission, objectives, and goals; identification and definition of the business functions; documentation of processes and activities and other business organizational related information for meeting current and future business needs. It drives the Information Sub-architecture. The builders of this sub-architecture include management and business process owners.**
- ***Information Sub-architecture*—The Information Sub-architecture is an aggregation of data entities and business functions, and their interaction which are represented in internal and external business requirements (i.e., reports, documents, etc.). The sub-architecture is depicted by entity relationship diagrams and functional decomposition diagrams, along with subsequent definitions (including matrices and detailed process definitions and diagrams) to define the current and future information needs of the organization. Development of the Information Sub-architecture can be performed during the definition of the Business Sub-architecture. It also includes the types/formats and repositories of information to support the mission(s). Together with the**

Business Sub-architecture, it drives the Applications, Data, and Technology Sub-architectures. The builders of this sub-architecture include business process owners and users.

- ***Applications Sub-architecture*—The Applications Sub-architecture is an aggregation of individual business applications and descriptive characteristics of current and planned business systems and initiatives, including a representation of the dependencies between business systems and the functional categorization of each business system. It can also include other application/types, such as operating systems, which overlap into the other sub-architectures, particularly the Technology Sub-architecture. Development of the Applications Sub-architecture can (and should) be done in concert with the Data Sub-architecture. The builders of this sub-architecture include process owners, users, and information systems staff.**
- ***Data Sub-architecture*—The Data Sub-architecture contains the aggregation of entities required to construct physical data stores (manual or electronic) such as files, spreadsheets, or databases to support current and future application systems. Various data is assembled such as the creator/owner, location, size, type, attributes, volatility, users, tools required for use of the business data, etc. The Data Sub-architecture can be depicted in several formats such as schemas, distribution diagrams, throughput and storage requirement tables. Development of the Data Sub-architecture can (and should) be done in concert with the Applications Sub-architecture. The builders of this sub-architecture include system and applications developers, data administrators, and data stewards.**
- ***Technology Sub-architecture*—The Technology Sub-architecture is a collection of technologies and components including descriptive high-level definitions of the current and future technical infrastructure. This includes usage information, as well as policies and statistics that apply to technology. The Technology Sub-architecture is usually classified into hardware, software, networks, and communications. Often training and support are included. Generally, the Technology Sub-architecture is considered defined when the technology infrastructure is defined to a sufficient level of detail such that costs may be easily determined and applied to Analyses of Benefits and Costs (ABC) and Return on Investment (ROI) determinations. The builders of this sub-architecture include users and information systems staff, especially configuration management and system operators." [9]**

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9 *US DoE Information Architecture Definition and Documentation Methodology*, 6 February 1997.

This model of an Information Architecture is quite appealing although it expands the scope of Information Architecture to encompass both the business model at the top, the application layer in the middle and the technology (or infrastructure) layer undergirding it all. This is clearly the broadest of the various definitions currently being applied.

The DoE Information Architecture is founded on eight principles, which are high-level statements of the DoE philosophy that provide the foundation for standards and policy. These principles provide a perspective for viewing the current baseline and for identifying the characteristics of a realigned information architecture. They apply as well to the FAA:

- **"DoE information products and services are user-centric and customer-driven.**
- **The DoE information architecture is based on modular components.**
- **Information architecture is based on an open systems approach.**
- **Security is designed into all architectural elements, balancing accessibility and ease of use with protection of data.**
- **Information is not only a Departmental asset, but also a National asset for which the DoE staff is the steward.**
- **DoE-wide access to information is the rule rather than the exception.**
- **The information architecture incorporates a robust interface that optimizes the nature, efficiency, and effectiveness of the human operator.**
- **DoE will have an information technology infrastructure that seamlessly links offices, programs, facilities, and field locations."**

Baseline and Transition Process. DoE approached its Information Architecture problem in three phases. In the *DoE Information Architecture, Volume I - The Foundations*, the agency provides the rationale for establishing a "DOE-wide" Information Architecture and presents the projected benefits for successful implementation of the DOE Information Architecture.

The *DoE Information Architecture, Volume II - The Baseline* documents a summary of the current information architecture, based on surveys received from various DoE sites. The objectives of the baseline are to:

- **"Analyze the Department's current information architecture baseline**
- **Depict the current technology base**
- **Identify the systems and data in place**
- **Map networks and protocols**

- **Determine existing software for all layers of the de facto information architecture, and**
- **Identify standards already in place**

DoE intends to use the *de facto* DoE information architecture baseline as the starting point for identifying future changes based on the following shortcomings that DOE has identified in its own information management practices. These shortcomings are fairly generic, especially for large agencies with complex missions, such as exist both at the DoE and FAA. These shortcomings are:

- **"Information technology, as implemented today, may be a barrier to Department-wide interoperability.**
- **Multiple networks exist; the current network architecture is a mesh of real and virtual assets and capabilities; difficulties in aligning physical and logical capabilities may be hindering the realignment of technologies to support the business areas.**
- **Duplicate data and redundant systems probably exist in many different ways.**
- **Interoperability, connectivity, and user accessibility to information can be improved but the mechanisms causing difficulties are not clearly identified.**
- **Ongoing processes and systems technologies initiatives provide the basis for evolutionary change and movement toward a vision architecture. An information architecture baseline should support proposed improvements."**

The baseline describes the DoE business enterprise and documents departmental core competencies and information management core competencies that cross the departments. The FAA may not wish to map the entire agency with this process at the level of detail described, but it is clear that a 'roadmap' of current processes, functions, and applications should be baselined as a focus for growth and change. A conclusion that one can draw from this description, as well as from the DoE pyramid above, is that information is not isolated from the architecture or from applications. It is at the heart of any agency's mission and business practice.

With reference to the DoE version of the NIST pyramid, the DoE baseline defines the five architectural components in its own terms:

- **"The business areas, organizations, and business entity relationship maps that are comprised in the Business Sub-architecture of the DoE Information Architecture;**

- **The source, throughput, and destination domains that define the Information Sub-architecture, as well as the Information Sub-architecture products, consumers and users, and information systems;**
- **The 600 DoE application systems that define the Applications Sub-architecture;**
- **DBMS systems that manage data in the Data Sub-architecture (no detailed department-wide data sub-architecture is identified here); and**
- **The hardware, software, and telecommunications technologies that are incorporated in the Technology Sub-architecture."**

Lastly, the baseline documents findings and conclusions in 14 focal areas determined to be of DoE management interest. Conclusions resulting from the baseline analysis follow. How many apply to the FAA?

1. **"The current baseline information architecture reflects widely varying relationships between the forms of information and related information technology functions. The overall trend is a decentralized movement toward interoperability and realignment of the information management architecture to satisfy business needs. Significant opportunities exist for information management to participate in ongoing business process reengineering and information architecture improvement efforts.**
2. **Without input based on business architecture reengineering plans, it is impossible to determine how well the business and information architectures are aligned to meet business objectives or where gaps exist. The analysis of organizations indicates the following.**
    - **There is no evidence of gross misalignment between DoE business lines and its information technology capabilities… Given the variety of information customers within and outside DoE, meeting or exceeding user and customer demands within the current architecture is a major ongoing achievement.**
    - **Interoperability problems exist in areas such as e-mail, document management and transfer, aging platforms, database (software and design), and diverse integrated desktop applications. These problems are being resolved by informal collaboration and adoption of solutions that cause the least technical disturbance. DoE organizations are pursuing strategies intended to employ common standards; however, the opportunities occur in the longer term and have had little impact so far. Architecture decisions are often made by shaping availability and delivering acceptable services rather than meeting the full range of user needs. This approach may not result in the right business decision; however, it does lead to a minimally acceptable technology level that delivers selected products and services across major**

parts of the enterprise. In many areas, technology is having a profound impact on how DoE does business.

- **A mixture of solutions, driven by the installed base, de facto market standards, and cost effectiveness is being employed. DoE technology architecture leaders are moving in the same direction, but that does not ensure future interoperability or connectivity or that the effects of system designs are transparent to users.**
- **Substantial cooperation exists among users and technology service providers. The expanded use of mature network technology and e-mail within the enterprise and to major customers has improved collaboration and communication…[Numerous existing] projects reflect the sharing of needs and views required to sustain continuous improvement in the baseline information architecture.**
- **A tremendous range of available technologies is displayed throughout the baseline; however, they are not expected to be fully integrated. At some infrastructure level, increasing integration of physical and logical information technologies is required…**

3. **Information architecture principles are guiding evolution toward a vision architecture, but there are no objective customer-satisfaction metrics in place to assist in guiding information architecture changes. The current baseline provides products and services determined by the installed architecture base rather than the requirements of reengineered processes. Often one impacts the other. Lack of sufficient infrastructure prevents rapid technology deployment to aid new business procedures while, in other instances, advanced technologies have not taken advantage of redesigned work flows. Adopting and upgrading technology are often based on subjective technology architecture impact forecasts, assessments, and anticipated funding constraints rather than on Departmental business opportunity and needs analysis.**
4. **The data sub-architecture needs systemic improvement to make inaccessible data reachable and viable. Organizational data resides on individual desktop platforms, in numerous (sometimes obsolete) databases, within COTS or custom applications, and between corporate systems and sites…**
5. **The major operational information architecture shortcoming is document transfer. The maturing Departmental and site network structure is in place, but only simple messages without attachments can be widely and reliably transmitted…**
6. **Several information architecture leadership opportunities offer procurement economies as well as increased organizational effectiveness. Consolidated procurements would be based on aggregating quantitative and performance**

requirements over the range of site needs rather than specifying single products or vendors. Centralized funding of site products and services may not be required; however, some reimbursement combination may be appropriate…

7. **The baseline has the seeds of change and modernization. Sites have special needs and expertise, which can be leveraged throughout the information management community, and are actively solving operational problems in the business and information sub-architectures. The baseline includes the necessary infrastructure but requires the application of structural information architecture principles to exploit the full potential. Use of this expertise will be even more essential in adapting the current telecommunications networks to incorporate wireless technologies.**
8. **The increase in information architecture awareness and the Department's willingness to address information architecture and interoperability issues provide hope and confidence… [The] DoE information architecture is being deliberately evolved from stovepipe and proprietary environments to a framework that encourages increased integration and increasingly more flexible and reconfigurable capabilities."**

Finally, in *DoE Information Architecture, Volume III - The Guidance*, the agency describes a solution path that:

- **"Provides the purpose of DoE information architecture guidance and its applicability to the Departmental information architecture program;**
- **Identifies the principles to be used in evaluating effective design and performance of internal or external information management initiatives that impact the… information architecture;**
- **Identifies the characteristics of information technology designs and development approaches to be used for… information management…;**
- **Provides the purpose of the information architecture program; identifies the roles of the…CIO and staff and field organizations within the architecture program;…and identifies the models and methodologies suitable for use in architectural designs and evolution;**
- **Describes the Departmental approach to information architecture using adopted and de facto standards in the design, acquisition, and implementation of the nested organizational architectures;**
- **Provides a short summary of the benefits of Department-wide guidance;**
- **Provides statutes, Directives, and other applicable references; [and]**

- **Describes several architecture configuration levels and presents a basic set of architectural configuration guidelines.**

The DoE Information Architecture was created as a management tool to illustrate the inter-connectivity of the business, information, and technology environments and their relationships at any point in time. To further the development of a concise and dynamic IA, DoE has developed an Information Technology Standards Process Guide in which are published the Information Technology standards that support the Architecture Model, especially the applications, data, and technology sub-architectures.

A companion document to the *DoE Information Architecture, Volume III - Guidance* is the *Information Architecture Definition and Documentation Methodology* presents a methodology for developing an information architecture using a phased approach. This document defines four major development phases of an information architecture, as depicted in Figure 5-2:

- **Plan the Architecture Project**
- **Document and Develop an As-Is Information Architecture**
- **Define a Future View of the Enterprise/Organization (for any organizational unit or level)**
- **Develop To-Be Sub-architectures**

DoE also has developed an *Information Architecture Tool-kit* as an initial checklist for organizations to develop information architectures, including forms for data collection and presentation. It contains a detailed description of each, including recommended implementation tools and resulting products. Table 5-1 provides a cross-reference between the phased methodology and the tool-kit.

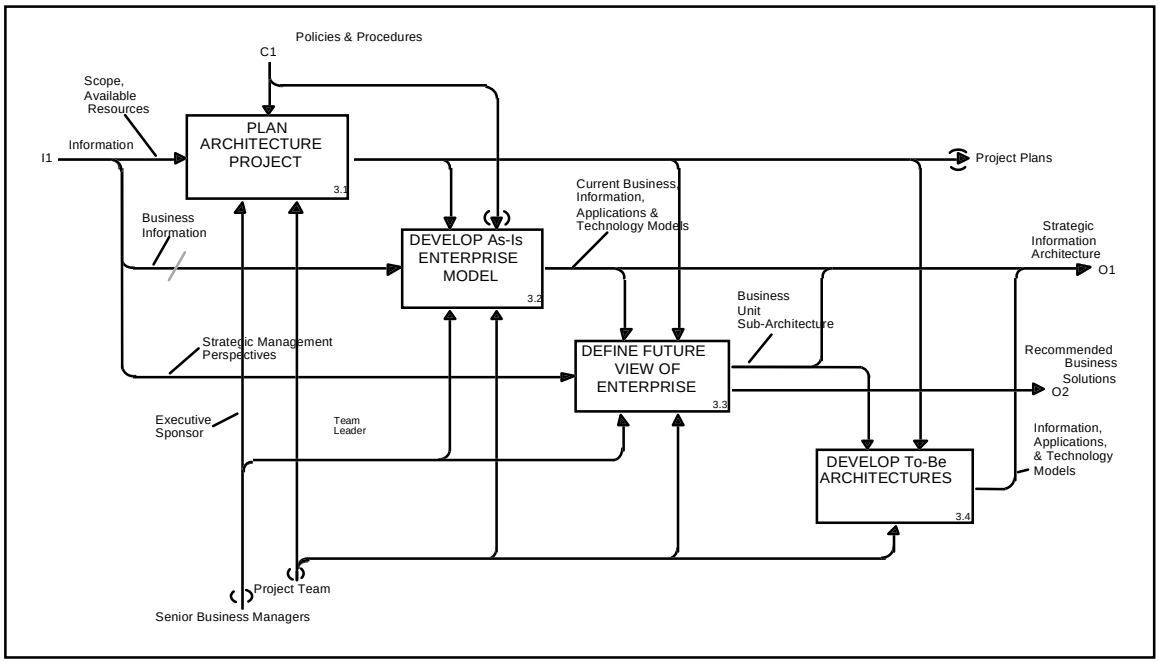

Figure 5-2. Phased Approach for IA Development

Table 5-1. Methodology and Tool-kit Cross-Reference

Methodology	*Tool-kit*
Plan Architecture Project	**I. Planning Initiation**
Document/Develop As-Is Information Architecture **Define Future View of Enterprise/Organization**	**II. Business Sub-architecture** **III. Current Information, Systems, & Technology Catalog**
Develop To-Be Sub-architectures	**IV. Data Sub-architecture** **V. Applications Sub-architecture** **VI. Technology Sub-architecture**

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Glossary

AOC	**Analyses of Benefits and Costs**
APP	**Application Portability Profile**
ASD	**(FAA) System Development & Program Evaluation (Organization)**
CIO	**Chief Information Officer**
COTS	**Commercial-off-the-Shelf**
DBMS	**Database Management System**
DoC	**Department of Commerce**
DoD	**Department of Defense**
DoE	**Department of Energy**
DSS	**Decision Support System**
EAP	**Enterprise Architecture Planning**
FAA	**Federal Aviation Administration**
GAO	**General Accounting Office**
ITA	**Information Technology Architecture**
JTA	**Joint Technical Architecture**
NIST	**National Institute of Standards and Technology**
OMB	**Office of Management and Budget**
OSE	**Open Systems Engineering**
PTO	**Patent and Trademark Office**
ROI	**Return On Investment**
SHADE	**Shared Data Environment**
SQL	**Structured Query Language**
TAFIM	**Technical Architecture for Information Management**
TRM	**Technical Reference Model**